

Preliminary Report
Hurricane Gordon
8-21 November 1994

Richard J. Pasch
National Hurricane Center
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Gordon, a complex system, followed an unusual, erratic path over the western Caribbean Sea and islands, Florida and the southwestern Atlantic. Its torrential rains caused a catastrophic loss of life in Haiti and extensive agricultural damage in south Florida.

a. Synoptic History

Disturbed weather was noted over the southwestern Caribbean Sea during much of the first week of November. Convection over the area was enhanced by the passage of two tropical waves during this period. The second of these waves induced the formation of a lower-tropospheric cyclonic circulation, as indicated by rawinsonde data, just to the north of Panama around 0000 UTC 6 November. Meteorologists at the NHC's Tropical Satellite Analysis and Forecast (TSAF) unit began tracking this circulation center from satellite imagery beginning on 6 November. By 1200 UTC 7 November, the convective cloud pattern associated with this circulation had enough curvature to warrant an initial satellite intensity classification, a T1.0 on the Dvorak scale. Early on the 8th, deep convection became concentrated in a cluster not far offshore of the southeast coast of Nicaragua. By 1800 UTC on the 8th, Dvorak intensity estimates from TSAF and the NESDIS Synoptic Analysis Branch (SAB) were T2.0 and T1.5 respectively, and surface observations showed the presence of a 25-knot circulation. The tropical depression stage of Gordon begins at this time (Table 1). Figure 1 shows the subsequent track, an interesting one indeed.

There was limited upper-level outflow from the system, primarily to the north and northeast, which favored very slow strengthening. The depression moved toward the coast of Nicaragua, and an Air Force Hurricane Hunter plane investigating the system found that the center was very near the coast by 1800 on the 9th. Spot wind reports from the aircraft suggested that the cyclone was nearing storm strength. However, the close proximity to land inhibited further intensification. The center hugged the coast of Nicaragua from 0000 to 1200 UTC on the 10th, and is estimated to have moved just onshore near Puerto Cabezas at 0600 UTC. Then, in response to a trough aloft to the northwest, the tropical cyclone turned northeast, moving back over the western Caribbean, and strengthened into Tropical Storm Gordon by 1800 UTC. Data from Air Force flights into Gordon showed that little additional intensification occurred over the ensuing 24 hours, as the storm moved slowly north-northeastward. Surface and aircraft data showed that Gordon consisted of a broad cyclonic circulation, which covered much of the western Caribbean, within which was embedded a smaller scale vortex.

Visible satellite pictures on the 11th revealed that Gordon was being sheared by upper level west-southwesterly flow. On 12 November, Gordon turned east-northeastward, and eastward, heading for Jamaica. Although bursts of strong convection were occurring near and east of the estimated storm center, the system remained disorganized with maximum sustained winds near 40 knots. The low-level center of Gordon was clearly exposed on visible satellite pictures on the 12th. Gordon's center moved across eastern Jamaica early on the 13th and accelerated further, nearing eastern Cuba by 1200 UTC that same day. As Gordon passed near Guantanamo, Cuba, the center became disorganized and difficult to locate. However, it is estimated from surface synoptic reports that the center that was previously being tracked moved rapidly northward across Cuba and was nearing the southern Bahamas by 1800 UTC 13 November. Around that time, Gordon's structure started to become more complicated.

While Gordon was crossing Cuba, an upper-tropospheric trough, which had been intensifying along 80°W north of 20°N, was cutting off a cyclonic circulation near the Straits of Florida. This upper-level system appeared to induce surface cyclogenesis in the vicinity of the central Bahamas. From 1800 UTC on the 13th through 0000 UTC on the 14th, there were multiple low-level centers embedded within a broader-scale circulation that covered most of central-eastern Cuba and the Bahamas. This larger circulation had accompanied Gordon since the tropical cyclone's inception, but was strengthened and modified by the influence of the upper-level cyclone. After 0000 UTC on the 14th, the cloud pattern and surface wind field resembled that of a subtropical cyclone, with a center of circulation becoming dominant just to the south of the central Bahamas.

A deep-layer ridge near the U.S. mid-Atlantic coast and a larger-scale deep-layer cyclone (within which Gordon was embedded) provided a steering current which carried Gordon, in its transformed state, west-northwestward. As a result of the increased surface pressure gradient between the broad low that accompanied Gordon and the high to the north, winds increased to near gale force over portions of the Florida peninsula late on the 13th. The center of Gordon passed south of the western Bahamas on the 14th and moved across the Straits of Florida early on the 15th. During this time, there was a lack of deep convection near the center and strongest winds were well-removed from the center. Radiosonde data were indicative of a cold-core system, except over the eastern portion of the circulation where warmer mid-tropospheric air was still prevalent.

As Gordon moved over the Straits of Florida, Air Force Hurricane Hunters estimated that the center was rather close to the coast of Cuba, since they were unable to close off a circulation to the north of the "no-fly" line off the north coast of the island. However, the center was broad at this time with light winds covering much of the southern Straits. Just before dawn on the 15th, the radar observations from Key West suggested a reformation of Gordon's center just to the south of the lower Florida Keys,

closer to deep convection. A special radiosonde release from Key West at 0600 UTC showed mid-tropospheric warming near the center of cyclone, indicating that Gordon was beginning to re-acquire tropical characteristics. The broad center moved northwestward over the lower Keys, and decelerated over the extreme southeast Gulf of Mexico. Early on the 16th, Gordon turned northward, and then north-northeastward, recurving under the influence of a mid-to upper-tropospheric shortwave trough moving eastward from the central United States. By 1300 UTC that day, the center crossed the southwest coast of Florida near Fort Myers. Maximum sustained winds were near 45 knots.

Moving northeastward, Gordon crossed the Florida peninsula, its center emerging over the Atlantic just north of Vero Beach around 2200 UTC 16 November. Central pressure was falling, and based on a report from the ship ZHEM7, maximum winds increased to near 55 knots shortly after Gordon moved back over the water. Gordon's northeastward motion accelerated on the 17th, and it strengthened into a hurricane. Just when it appeared to be headed safely out to sea, however, the hurricane abruptly slowed down and turned northward, then northwestward, and then west-northwestward, threatening the coast of North Carolina. This turn of events could be attributed to a mid-tropospheric ridge, which built over the eastern U.S. behind the shortwave trough that brought about Gordon's latest recurvature, and the fact that the trough essentially "out-ran" Gordon. The center of the hurricane came within about 80 n mi of the Outer Banks at 1200 UTC 18 November, before turning southward and south-southeastward. Gordon weakened to a tropical storm around 1800 UTC on the 18th as it entrained cooler, drier air into its circulation and was affected by northwesterly shear. Turning southward and then southwestward, weakening Gordon executed a "figure 8" track off the southeast U.S. coast. Gordon lost most of its deep convection on the 19th, and weakened to a depression early on the 20th. The weakening depression turned westward and west-northwestward, crossing the coast of Florida near Cape Canaveral as an inconsequential tropical cyclone. Gordon turned northward, then north-northeastward, crossed Georgia, and dissipated over South Carolina.

b. Meteorological Statistics

The "best track" positions and intensities, every six hours, for Gordon are listed in Table 1. Figures 2 and 3 show the best track pressure and wind curves, respectively, for Gordon as a function of time, along with the observations on which these curves are based. The observations are from Air Force Reserve unit and NOAA reconnaissance aircraft reports, satellite-derived intensity estimates (using the Dvorak technique applied by the NHC's TSAF unit, the NESDIS Synoptic Analysis Branch (SAB), and the Air Force Global Weather Central (AFGWC)), and surface reports from ships, buoys and land stations.

Table 2a lists selected surface observations taken during Gordon. A number of observing sites reported sustained winds of tropical storm force. Some regional maxima are of interest. In

→ Florida, the highest known sustained wind speed measurement from a land station, 46 knots, was from Virginia Key. A peak gust of 72 knots was recorded by an amateur meteorologist in southern Dade County. A 10-minute average wind speed of 62 knots was obtained from Diamond Shoals lighthouse, off the North Carolina Outer Banks. The 60-knot 1-minute winds with peak gusts to 104 knots, reported from the Guantanamo Navy base, occurred in a thunderstorm microburst and is not considered representative of the intensity of the tropical storm when it was near that site.

There were a number of ship reports of tropical storm force winds associated with Gordon, and these are listed in Table 2b. Ships WPPO and KLHC reported the highest sustained winds, 68 knots, and ship LAHE2 reported the lowest pressure, 987 mb.

The Air Force Reserve's Hurricane Hunter unit carried out numerous missions into Gordon, providing valuable information on its position, intensity and wind distribution. Gordon's peak intensity is estimated to have occurred around 0000 UTC 18 November, when reconnaissance data from the Hurricane Hunters indicated a minimum pressure of 980 mb. Peak flight-level (700 mb) winds of 96 knots were measured at 0123 UTC. This suggests maximum 1-minute surface winds near 75 knots.

Gordon produced heavy rains over Jamaica, eastern Cuba and Hispaniola. In Hispaniola the persistent southerly flow to the east of the broad circulation that accompanied Gordon, combined with upslope motion over steep topography, generated prolonged rains that led to disastrous floods and mud slides. Gordon also dumped heavy rains over the Florida peninsula, except for the west coastal area north of Fort Myers. Storm total rainfall amounts of 6 to 9 inches occurred over most of the eastern third of the peninsula, with totals to almost 11 inches in Volusia county, 12 or 13 inches over portions of southern and northern Dade county and as high as 15 or 16 inches in some locations in Broward county.

There were six confirmed tornadoes associated with Gordon, all in Florida. Four of these were in Palm Beach County: one in Delray Beach; one in Jupiter; one in Gulf Stream; and, one in Lake Worth. A tornado touchdown was also reported in southern Volusia County in the Iron Bend area. By far the most significant tornado occurred in southern Brevard County near the towns of Micco and Barefoot Bay. This tornado originated as a waterspout and moved onshore along a west-northwest path, striking the Snug Harbor/Barefoot Bay mobile home communities. Its remnant, a funnel cloud, was last sighted near Interstate 95 in southern Brevard County.

c. Casualty and Damage Statistics

Although the exact death count will probably never be known, flooding and mud slides due to Gordon caused a catastrophic loss of life in Haiti. On 19 November, the Associated Press reported (quoting Haitian government officials) 531 deaths in Haiti. On 22 November, a bulletin from the Port-au-Prince Radio Metropole (in French) quoted an announcement, made the previous day, from the

Haitian Ministry of Defense that the number of reported deaths was 2,000. However, according to Reuters News Agency, a Haitian Ministry of Defense source was quoted on 21 November as saying "there could be up to 2,000 dead". The Miami Herald reported on 24 November that the death toll in Haiti was at least 829 and "could go much higher". Lastly, a report from the United Nations Department of Humanitarian Affairs, Geneva on 21 December shows that the death toll in Haiti was "finally estimated" at 1,122. This last figure appears to be the most reliable one.

United Press International (UPI) reports indicate that there were 6 deaths in Costa Rica. Other reports show 5 deaths in the Dominican Republic, 2 in Jamaica, and 2 in Cuba.

There was a total of 8 deaths in Florida directly attributable to Gordon. One man drowned off Ft. Lauderdale Beach in Broward County in a rip current while rescuing his 8-year old son. One male surfer drowned off Haulover Beach in north Dade County. One woman drowned along a north Dade beach. One man drowned and one woman nearly drowned in Dade county when a car plunged into the Miami River during heavy rains. One man drowned in Dade county when a car plunged into a canal during heavy rains. Two men drowned when a boat was overturned at Hillsboro Inlet in Broward county by swells from Gordon (then located off the Georgia coast). One 74-year old man was killed by trauma to the head, received during the tornado in Brevard county. This tornado also caused 40 injuries (six people hospitalized, two serious injuries).

Most of Gordon's damage was due to fresh water flooding of agricultural areas (vegetables and tropical fruits were the most severely affected crops) in Dade and Collier Counties. In south Florida, some trees, power lines, and traffic signals were blown down. Power was disrupted to 425,000 customers. Gordon caused a 508-foot (154 m) Turkish cargo vessel to drag anchor off Ft. Lauderdale, running it aground less than 50 yards off the beach.

Tornadoes in Jupiter and Gulf Stream caused no known damage; the tornado in Delray Beach caused minor damage; and the tornado in Lake Worth uprooted several trees, damaged 2 business and 39 homes. The Volusia County tornado knocked numerous trees down and did minor damage to homes. The Brevard County tornado did considerable damage in the Snug Harbor/Barefoot Bay mobile home communities. About 62 mobile homes were destroyed, 46 received major damage and 181 had minor damage.

A 49-foot sailboat was disabled about 100 n mi off of Norfolk, Virginia. The vessel's crew of three was rescued via helicopter by the Coast Guard.

There was significant beach erosion along portions of the Florida east coast and the North Carolina coast. Five homes were destroyed along the Outer Banks. However, those structures had already been condemned due to damages received a year earlier in Hurricane Emily.

Gordon caused an estimated \$275 million in agricultural losses in Florida. Insured property damage, not including that covered by the Federal Flood Insurance Program, is estimated at \$60 million. Additional damage to property covered by the Flood Program, uninsured property, utilities and public works, brings the total damage estimate from Gordon in the United States to near \$400 million.

d. Forecast and Warning Critique

Predicting the track of Gordon proved to be a challenge for forecasters. The objective track prediction models frequently had trouble handling this atypical system, and often gave conflicting guidance; this translated into some large official forecast errors. Table 3a lists the average official track forecast errors and the number of cases for Gordon, excluding the depression stage, and Table 3b lists the average errors for some of the models. It can be seen that the average official errors are 10 to 30 per cent higher than the most recent decadal average. The biggest track prediction errors were incurred after Gordon exited Florida into the Atlantic, when it was thought (for a while) that the system would be carried well out to sea. Comparing Tables 3a and 3b reveals that the average official forecast errors were generally better than, or comparable to, the average errors for the models shown. Exceptions were the deep BAM at hours 24-48, and the GFDL model at hours 48 and 72, which had noticeably lower errors than the official forecast.

More often than not, the intensity of Gordon was slightly underforecast in the NHC advisories from the time of its formation up to the time it reached Florida. Part of the negative bias could be attributed to the fact that it was expected that the storm would be in a strong shear environment, and the subtropical-type transformation/development was not fully anticipated in the official forecasts. There were some larger magnitude underforecasts (up to 30-40 knots for 36-48 hour forecasts) for the time that Gordon was strengthening into a hurricane. After that time, Gordon was not predicted to weaken as rapidly as was observed.

Table 4 lists the various watches and warnings for Gordon. The tropical storm warning issued for southeast Florida and the Keys on 14 November replaced a gale warning that had been in effect since the previous day. This was done to heighten awareness of the weather situation, even though the predicted wind conditions had not changed significantly. A minor miscommunication with the government of the Bahamas resulted in some slight discrepancies in the status of tropical storm warnings over the northwest Bahamas on 15-16 November.

Table 1. Preliminary best track, Hurricane Gordon,
8-21 November, 1994.

Date/Time (UTC)	Position		Pressure (mb)	Wind Speed (kt)	Stage
Lat. (°N)	Lon. (°W)				
8/1200	11.9	82.3	1009	25	Tropical Depression
1800	12.0	82.5	1008	25	" "
9/0000	12.3	82.8	1007	30	" "
0600	12.5	83.0	1007	30	" "
1200	12.8	83.2	1007	30	" "
1800	13.2	83.4	1007	30	" "
10/0000	13.6	83.4	1007	30	" "
0600	14.0	83.4	1008	30	" "
1200	14.3	83.2	1008	30	" "
1800	14.6	82.7	1006	35	Tropical Storm
11/0000	15.1	82.4	1006	35	" "
0600	15.7	82.3	1003	35	" "
1200	16.3	82.2	1005	35	" "
1800	16.9	81.5	1004	35	" "
12/0000	17.2	80.8	1000	40	" "
0600	17.4	80.2	999	40	" "
1200	17.5	79.8	999	40	" "
1800	17.4	79.2	999	35	" "
13/0000	17.6	77.9	999	35	" "
0600	18.3	76.0	1001	40	" "
1200	19.9	75.0	1000	40	" "
1800	21.5	75.4	1001	40	" "
14/0000	22.1	76.3	999	40	" "
0600	22.7	77.5	998	45	" "
1200	23.2	78.3	997	45	" "
1800	23.4	79.1	998	45	" "
15/0000	23.6	79.9	998	45	" "
0600	23.9	80.8	999	45	" "
1200	24.5	81.6	999	45	" "
1800	24.9	82.1	998	45	" "
16/0000	25.4	82.5	998	45	" "
0600	25.7	82.4	997	45	" "
1200	26.4	82.0	995	45	" "
1800	27.1	81.4	995	45	" "
17/0000	28.0	80.0	993	55	" "
0600	29.0	78.5	989	55	" "
1200	30.0	76.7	987	60	" "
1800	31.5	74.8	981	65	Hurricane
18/0000	33.1	74.2	980	75	" "
0600	33.5	74.7	981	70	" "
1200	33.7	75.7	984	70	" "
1800	33.2	75.9	986	60	Tropical Storm
19/0000	32.5	75.5	992	50	" "
0600	31.6	75.0	996	45	" "
1200	31.1	74.8	1000	40	" "
1800	30.4	75.0	1005	35	" "
20/0000	29.8	75.3	1007	35	" "
0600	28.9	76.2	1008	30	Tropical Depression
1200	28.4	77.2	1009	30	" "
1800	28.2	78.6	1009	25	" "
21/0000	28.2	79.8	1010	25	" "
0600	29.2	81.5	1012	20	" "
1200	31.3	81.8	1013	20	" "
1800	34.1	79.8	1013	20	" "
22/0000					Dissipating
18/0000	33.1	74.2	980	75	Minimum Pressure
10/0600	13.9	83.3	1008	30	Landfall near Puerto Cabezas, Nicaragua
13/0300	17.9	76.8	1000	35	Landfall near Kingston, Jamaica
13/1300	20.0	74.9	1000	40	Landfall near Guantanamo, Cuba
15/1300	24.6	81.7	999	45	Landfall near Key West, Florida
16/1300	26.5	81.9	996	45	Landfall near Fort Myers, Florida
21/0300	28.5	80.6	1011	25	Landfall near Cape Canaveral, Florida

Table 2a. Hurricane Gordon selected surface observations, November 1994.

Location	Minimum sea-level pressure		Maximum surface wind speed (knots)			Storm surge (tide height above normal) (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	1-minute average	Peak gust	Date/time (UTC) ^a		
Florida							
NOAA Buoy 41010 (28.9N 78.5W)	988.2	17/0700	34 ^d	46	17/0800		
NOAA Buoy 41006 (29.3N 77.3W)	990.2	17/1000	34 ^d	45	17/0600		
Vero Beach Airport (VRB)	994.9	16/2151, 2252		36	15/0423		6.30
Melbourne (Palm Bay)	995.0	16/1630	29	36	15/1625		6.60
Melbourne Airport (MLB)	996.3	16/2250		39	15/2028		9.20
Melbourne Beach				44	15/2019		
Naples Airport (APF)	996.3	16/1155	20	29	16/0816, 1031		
NOAA Buoy 41009 (28.5N 80.2W)	996.4	17/0000	33 ^d	44	16/0900		
Fort Myers (FMY)	996.6	16/1355					
Regional SW Airport (RSW)			28	45	16/1648		
West Palm Beach (PBI)	998.0	16/2145	34	49	16/0404		8.87
Lake Worth CMAN	998.9	16/2100	41 ^b	52	14/1300		
Fort Lauderdale	998.6	16/2147	25	30	16/1747		
Executive Airport (FXE)							
Miami Beach (MIBF1)			34	48	14/1448	2.0 ^c	5.76
NOAA Buoy 42037 (24.5N 81.4W)	998.9	15/1000	26 ^d	33	14/1400, 1600		
Long Key CMAN	999.1	15/0800	29 ^b	35	14/1700		
Fort Lauderdale/	999.3	16/1950	28	40	15/1050		
Hollywood International Airport (FLL)							
West End (Grand Bahama) CMAN			27 ^b	35	14/1800		
Sombrero Key CMAN	999.4	15/0800	35	39	14/2200		
Key West (EYW)	999.7	15/0920	26	43	14/2030		0.84
Sand Key CMAN	999.9	15/0800	37 ^b	43	14/1900		
Molasses Reef CMAN	1000.2	15/0700	39 ^b	50	14/1300		
Miami International Airport (MIA)	1000.0	16/2000	26	43	15/1506		6.89
Tamiami Airport	1000.3	16/1950	25	37	15/0247		6.56
West Kendall (TMB)							
Opa-Locka (OPF)	1000.3	16/2247	25	38	15/1547		
Orlando Airport	1000.3	16/2150	17	27	17/0050		
AOML (Virginia Key)	1001.0	16/2200	46	56	15/0540		6.76

Table 2a (cont.)

Location	Minimum sea-level pressure		Maximum surface wind speed (knots)			Storm surge (tide height above normal) (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	1-minute average	Peak gust	Date/time (UTC) ^a		
MCAS Cherry Point	1001.3	18/0555	22	34	18/1430		1.12
MCAS New River	1002.7	18/0610	23	41	18/1156		0.30
WSO Wilmington (ILM)	1004.5	18/1050	28	36	18/1750		0.15
NOAA Buoy 41002 (32.3N 75.2W)	992.5	19/0100	35 ^d	36	18/2300		
NOAA Buoy 41001 (34.7N 72.6W)	1002.7	18/0300	47 ^d	63	18/0300		
NOAA Buoy 41004 (32.5N 79.1W)	1004.5	17/1000	34 ^d	44	17/1000		
Bahamas							
Cockburn, San Salvador	1000.7	14/0000					
NOAA Buoy 41016 (24.6N 76.5W)	1000.7	14/0900	39		14/0000		
Nassau			20	32	13/1500		
Kemp's Bay, Andros			40		14/0000		
Cuba							
Guantanamo	999.0	13/0900	60	104	13/0858		
Jamaica							
Kingston	1002.0	13/0429	25		12/2300		

^a Time of 1-minute wind speed unless only gust is given.

^b C-MAN stations report 2-minute average winds.

^c Estimated.

^d NOAA buoys report 8-minute average winds.

Table 2b. Ship encounters of 34-knot or higher winds, Hurricane Gordon, 1994

Tropical Cyclone	Ship ID	Date	Time	Position		Wind (kt)	Pressure
		Mo/Day	UTC	LatN	LonW	Dir/Speed	(mb)
Gordon	3E2K9	11/13	1200	22.9	72.2	120/34	1009.0
	3EKI3	11/13	1200	20.5	74.2	130/35	1002.0
	C6HE2	11/13	1800	24.5	74.5	060/44	1004.5
	C6CM7	11/13	1800	25.0	75.3	080/42	1001.7
	C6TV	11/13	1800	22.0	70.8	150/34	1004.5

Table 2a (cont.)

Location	Minimum sea-level pressure		Maximum surface wind speed (knots)			Storm surge (tide height above normal) (ft)	Rain (storm total) (in)
	Pressure (mb)	Date/time (UTC)	1-minute average	Peak gust	Date/time (UTC) ^a		
Miami (12245 SW 71 Ct)	1001.3	16/2010	21	72	15/0605		10.60
Fowey Rocks CMAN	1001.0	16/2000	46 ^b	54	15/0800		
Homestead AFB (HST)	1001.4	16/2055					13.15
Dry Tortugas CMAN	1000.4	15/1900	31 ^b	40	14/2200		
Daytona Beach	1001.8	16/1930, 2100					10.70
Hialeah (4391 W.9 Ct.)	1003.7	16/1959	19	30	15/0359		5.19
Saint Augustine CMAN	1004.8	16/2200	35 ^b	37	17/0000		
Cooperstown (central Broward County)							16.10
Andytown (central Broward County)							16.00
Fort Lauderdale (Dixie Water Plant)							14.68
Hollywood							12.21
North Dade County (Norwood Water Plant)							11.73
North Miami (Keystone Point)							11.09
Boynton Beach							10.79
Coral Springs							10.09
Palm Beach Gardens							9.75
West Perrine							9.50
Boca Raton							9.14
Sanford							8.80
Titusville							8.75
Melbourne NWSO							8.50
Vero Beach 4W							8.40
Stuart							7.95
Belle Glade							5.68
Orlando MCO							5.80
Clewiston							4.11
Imokalee							3.76
Moore Haven							3.39
Naples (Naples Conservatory)							2.43
North Carolina							
Diamond Shoals CMAN	999.5	18/0900	62 ^b	76	18/0700		
Buxton	1000.2	18/1030	44	50	18/1043	2.7	1.29

Table 2b (cont.)

Tropical Cyclone	Ship ID	Date Mo/Day	Time UTC	Position		Wind (kt) Dir/Speed	Pressure (mb)
				LatN	LonW		
Gordon	WZJG	11/13	1800	24.3	73.3	070/35	1005.0
	WTL479	11/14	0000	21.8	72.3	180/39	1003.0
	C6TV	11/14	0000	23.1	72.6	150/34	1001.4
	ELFT8	11/14	0000	22.9	72.5	100/35	1000.0
	C6CM7	11/14	0000	24.1	73.8	070/45	998.5
	KNJN	11/14	1200	25.3	79.8	050/45	1003.0
	WIBK	11/14	1300	24.3	81.5	360/40	1018.5
	WIBK	11/14	1600	24.5	80.8	360/40	1005.0
	WIBK	11/14	1900	24.8	80.4	040/52	1002.9
	WIBK	11/14	2200	25.2	80.0	070/50	1005.5
	VRMH	11/15	0000	24.2	82.3	360/40	1002.6
	KNJN	11/15	0000	26.0	78.0	050/45	1006.0
	VRMH	11/15	0600	24.4	81.1	060/34	999.5
	VRMH	11/15	1200	25.2	79.8	120/40	1002.9
	SHIP	11/15	1200	25.4	77.5	140/37	1007.8
	DGDC	11/15	1500	25.4	79.9	120/42	1004.0
	VRMH	11/15	1800	26.2	79.0	130/37	1006.8
	DGDC	11/15	1800	26.5	79.7	120/35	1006.2
	3EKH3	11/15	1800	24.0	79.5	160/35	1006.0
	ZHEM7	11/15	2100	24.1	85.2	340/49	1005.0
	DGDC	11/15	2100	27.6	79.7	070/40	1006.8
	DGDC	11/16	0000	28.6	79.7	080/37	1010.2
	ZCAQ	11/16	0000	29.9	79.7	090/34	1011.0
	3EKH3	11/16	0600	27.1	77.9	140/39	1006.0
	ZHEM7	11/16	2100	27.3	79.7	160/58	998.0
	OXKT2	11/16	2100	24.6	79.6	200/36	1005.0
	ZHEM7	11/17	0000	28.2	79.6	140/54	996.0
	DGDC	11/17	0600	31.9	80.2	010/41	1005.9
	WZJF	11/17	0600	28.0	78.2	200/41	993.0
	NNAC	11/17	1200	29.0	76.0	200/45	989.5
	SHIP	11/17	1200	36.3	74.7	080/45	1012.3
	SHIP	11/17	1200	32.2	79.2	010/42	1002.4
	P3QG4	11/17	1800	27.6	74.1	230/40	1002.0
	4XIL	11/17	1800	27.7	77.5	300/35	1003.0
	3FJF3	11/17	1800	30.0	72.0	- /60	-
	FNPA	11/17	1800	30.5	79.4	350/35	1008.0
	WMBQ	11/17	1800			060/37	1003.5
	SHIP	11/17	1800	37.1	75.1	070/40	-
	SHIP	11/17	1800	35.2	75.2	070/45	1006.0
	KLHC	11/17	2100	32.6	71.8	140/48	1000.3
	LAHE2	11/17	2100	34.0	73.5	090/35	1000.5
	WPVD	11/17	2100	32.7	78.2	360/40	1001.0

Table 2b (cont.)

Tropical Cyclone	Ship ID	Date Mo/Day	Time UTC	Position		Wind (kt) Dir/Speed	Pressure (mb)
				LatN	LonW		
Gordon	ELUI	11/17	2100	34.0	76.5	050/38	1010.1
	VRIU	11/18	0000	34.2	71.8	080/44	1003.2
	WPPO	11/18	0000	33.5	72.2	120/68	1002.5
	KLHC	11/18	0000	33.4	72.3	110/68	998.8
	LAHE2	11/18	0000	33.8	74.4	040/58	990.0
	X	11/18	0000	34.2	76.2	- /50	1002.8
	DGDC	11/18	0000	32.5	75.1	360/42	994.2
	NWAC	11/18	0000	31.2	78.1	350/35	1002.4
	LAHE2	11/18	0300	33.3	75.2	040/58	987.0
	DGDC	11/18	0300	32.2	74.4	230/45	994.1
	WLDW	11/18	0300	36.5	74.9	110/37	1001.9
	VRIU	11/18	0300	34.0	71.7	070/52	1002.7
	SHIP	11/18	0300	32.0	79.3	360/45	1007.5
	VRIU	11/18	0600	33.8	71.9	090/44	1002.8
	WLDW	11/18	1200	34.6	76.0	100/55	999.5
	LAHE2	11/18	1500	32.3	77.4	320/52	1003.0
	WTEZ	11/18	1500	34.6	76.6	020/34	1001.3
	WLDW	11/18	1500	34.1	76.8	250/60	999.6
	P3QG	11/18	1800	30.8	78.0	270/40	1005.0
	WLDW	11/18	1800	33.4	77.4	330/55	999.9
	LAHE2	11/18	1800	32.4	78.0	320/40	1003.0
	NRKN	11/18	1800	33.9	76.6	040/35	997.0
	WZJD	11/18	2100	37.4	71.4	140/45	1012.5
	WLDW	11/18	2100	33.0	78.0	320/40	1000.4
	WLDW	11/19	0000	32.4	78.8	340/40	-
	P3QG4	11/19	0000	31.7	79.0	330/36	1007.2
	OXKT2	11/19	0600	33.0	77.9	350/38	1009.0
	OXKT2	11/19	1500	34.9	75.3	360/36	1016.0
	4XIL	11/19	1800	32.7	78.2	040/35	1018.0
	DHIO	11/20	0000	30.1	78.1	360/45	1011.4

Table 3a. Hurricane Gordon average official track forecast errors, excluding the tropical depression stage, in nautical miles.

	forecast period (hours)					
	0	12	24	36	48	72
Gordon (number of cases)	17 (38)	68 (36)	134 (34)	203 (32)	259 (30)	332 (26)
1984-1993 Atlantic average	17	52	101		199	302

Table 3b. Hurricane Gordon average track model forecast errors, excluding the tropical depression stage, in nautical miles. This is a non-homogeneous comparison.

model	forecast period (hours)				
	12	24	36	48	72
AVNI (number of cases)	117 (24)	217 (24)	312 (22)	403 (22)	496 (14)
A90E (number of cases)	79 (36)	146 (34)	223 (32)	317 (30)	374 (26)
BAMD (number of cases)	60 (36)	100 (34)	161 (32)	217 (30)	394 (26)
CLIPER (number of cases)	87 (35)	181 (33)	282 (31)	375 (29)	425 (25)
GFDI (number of cases)	83 (30)	158 (28)	203 (25)	241 (25)	283 (23)
QLMI (number of cases)	108 (34)	218 (32)	408 (30)	451 (28)	593 (24)
VBAR (number of cases)	79 (33)	142 (33)	209 (32)	287 (30)	348 (26)

Table 4. Watch and warning summary, Hurricane Gordon.

Date/Time (UTC) /Action	Location
12/0300 Tropical Storm Watch Issued	Jamaica
12/0900 Tropical Storm Warning Issued and Tropical Storm Watch Discontinued	Jamaica
12/1500 Tropical Storm Warning Issued	South Coast of Cuba from Camaguey through Guantanamo
13/0900 Tropical Storm Warning Issued	Southwest Peninsula of Haiti
13/1200 Tropical Storm Warning Discontin.	Jamaica
13/1500 Tropical Storm Warning Issued	Southeast and Central Bahamas Southeast of Eluethera
13/1500 Tropical Storm Warning Discontin.	Southwest Peninsula of Haiti
13/2100 Tropical Storm Warning Extended	Remainder of the Bahamas
14/0000 Tropical Storm Warning Discontin.	Cuba
14/0900 Tropical Storm Warning Issued	Florida Southeast Coast and Keys from Jupiter Inlet southward to the Dry Tortugas
14/1500 Tropical Storm Warning Issued	Florida West Coast from Boca Grande southward including Florida Bay and Lake Okeechobee
14/1500 Tropical Storm Warning Issued	Northwest Bahamas from Eluethera Westward
14/1500 Tropical Storm Warning Discontin.	Bahamas (south) east of Eluethera (and the Turks and Caicos Islands)
14/2100 Tropical Storm Warning Issued	Bimini and Grand Bahama
14/2100 Tropical Storm Warning Discontin.	Bahamas except Bimini and Grand Bahama (and Abacos)
15/1500 Tropical Storm Warning Extended	Florida West Coast from Boca Grande to Longboat Key
15/1500 Tropical Storm Watch Issued	Florida West Coast from Longboat Key northward to Bayport
15/2100 Tropical Storm Warning Extended	Florida East coast from Titusville southward and on the Florida West Coast southward from Bayport including Tampa Bay
15/2100 Tropical Storm Watch Discontinued	Florida west coast from Longboat Key northward to Bayport
15/2100 Tropical Storm Warning Discontin.	Bimini and Grand Bahama
16/1500 Tropical Storm Warning Discontin.	Florida West Coast north of Venice
16/1800 Tropical Storm Warning Discontin.	Florida West Coast north of Flamingo
16/2100 Tropical Storm Warning Discontin.	Florida West Coast and Keys from Key Largo southward and Florida Bay and Lake Okeechobee
17/0000 Tropical Storm Warning Discontin.	Florida
17/0300 Tropical Storm Warning Discontin.	Bahamas
18/0500 Hurricane Warning Issued	North Carolina Coast from the North Carolina-Virginia Border Southward to Bogue Inlet including Albermarle and Pamlico Sounds
18/2100 Hurricane Warning Discontinued	North Carolina

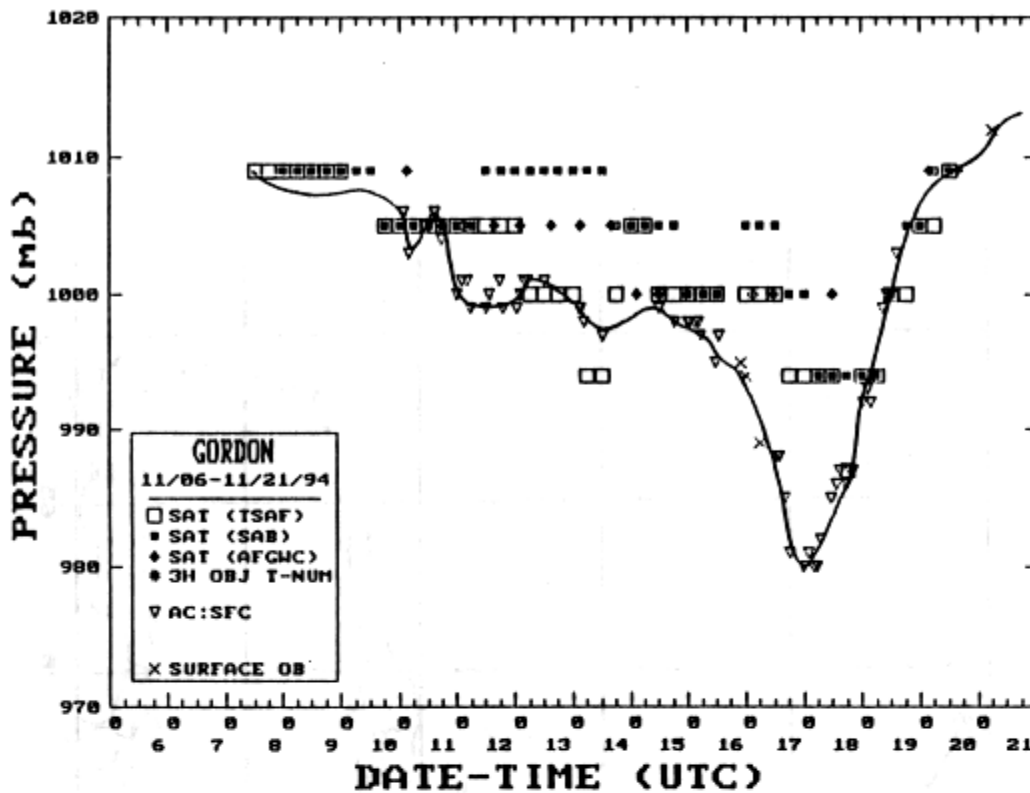


Fig. 2. Best track minimum central pressure curve for Hurricane Gordon, 1994.

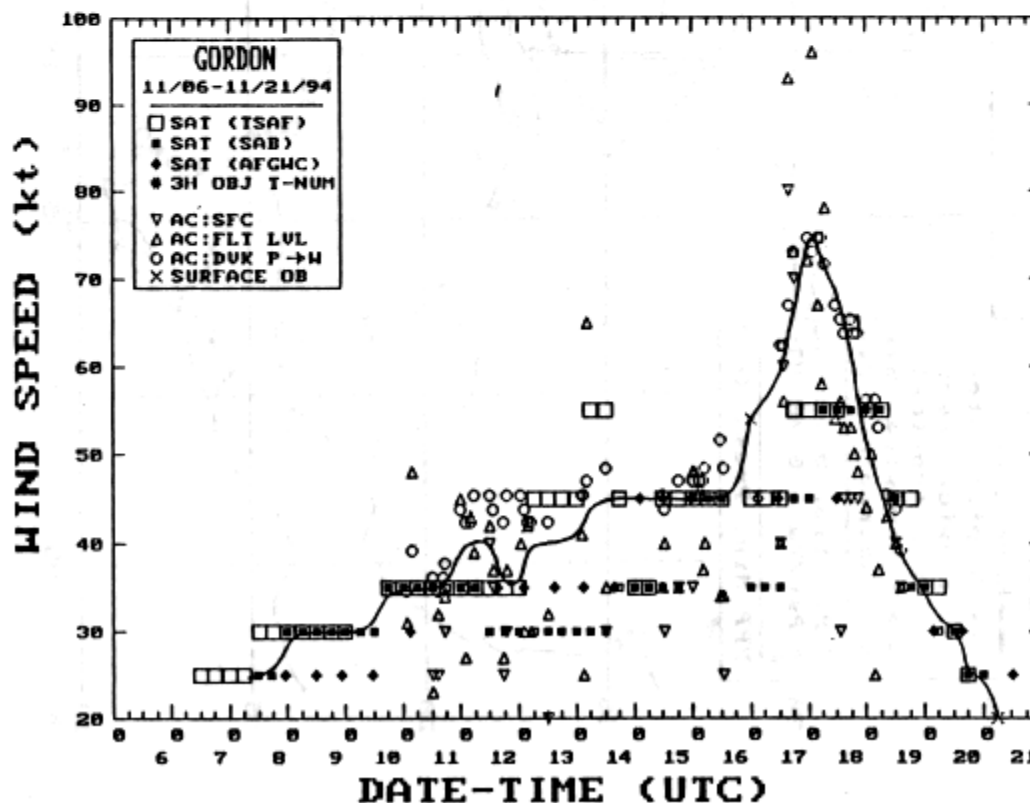


Fig. 3. Best track maximum sustained wind speed curve for Hurricane Gordon, 1994.

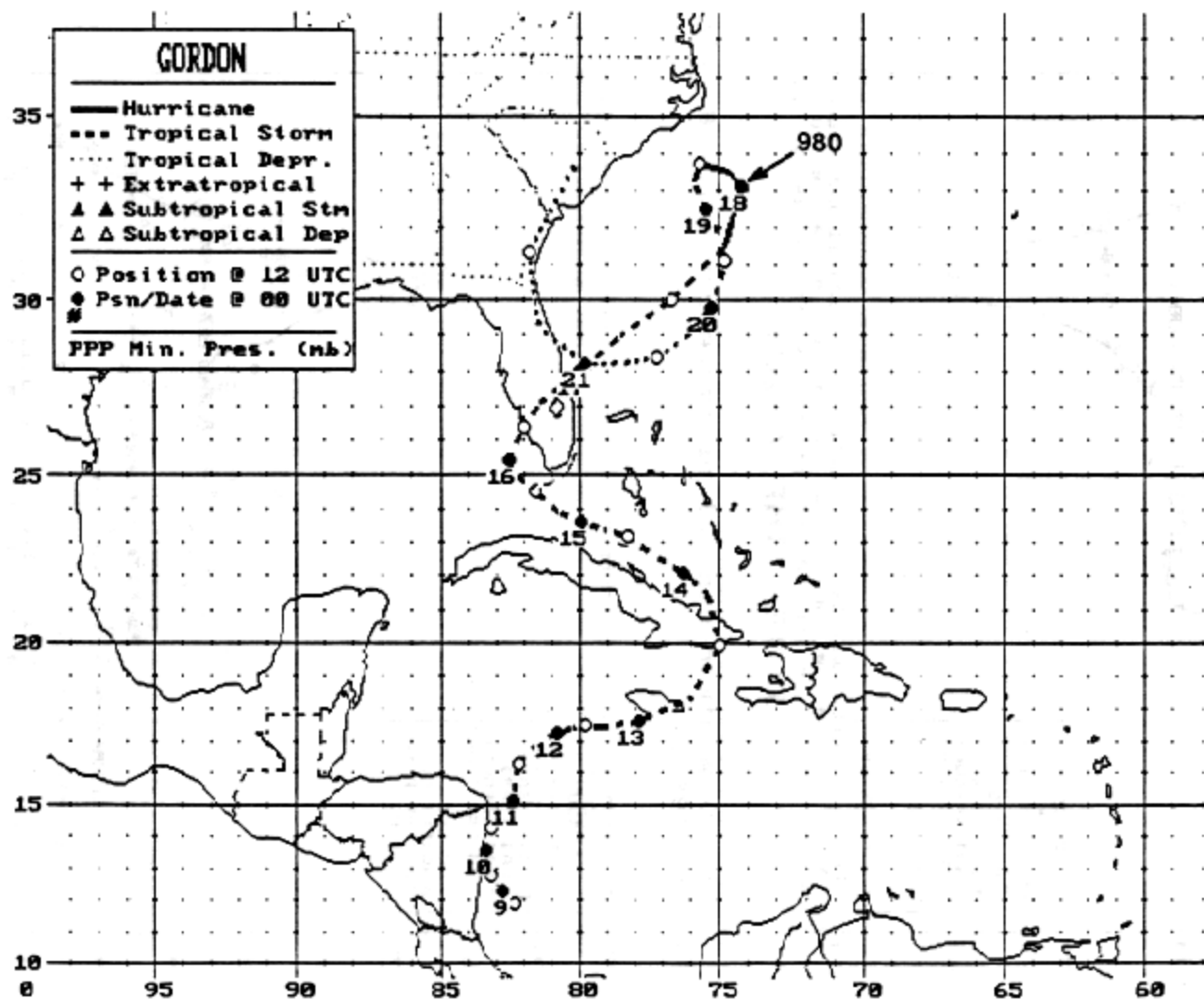


Fig. 1. Best track positions for Hurricane Gordon, 1994.